With a correctly constructed nozzle the value of </> is comparatively high, experiments having shown values varying from about 0*94 to 0*97.

In actual practice the mean value of 0-955 probably represents a fairly satisfactory figure.

As will be fully explained later, where the heat drop is great, to approach the full theoretical velocity a divergent or expanding nozzle shape is required.

Critical Pressure Ratio.—Consider a simple nozzle as shown in fig. 3 connecting two closed chambers in which exist steam pressures of f_l and P_2. At first let these two pressures be equal; equilibrium will then exist, and no flow will take place through the nozzle. If now, whilst maintaining the initial pressure P_x at a constant value, the pressure P_2 be decreased, steam will begin to flow through the nozzle, and as the discharge pressure P_2 is gradually reduced the quantity of steam passed by the nozzle will increase.

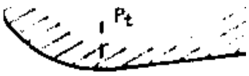

Fig. 3.—Simple Nuzzle

Fig. 3A.-"- ~I)ivcrKe,'fU Nozzle

At first as the discharge pressure falls the quantity of steam passed will increase rapidly, but as the pressure continues to fall the rate of increase of the discharge diminishes, and when the ratio of the pressures P_2 : $l^{>}_{1}$ reaches a value between 0-5 and 0-6 the discharge quantity will reach a maximum value; any further reduction of P_2 will produce no further increase in the amount of steam flowing. This particular pressure ratio at which the maximum discharge is reached is known as the critical pressure ratio, and when this ratio exists the velocity of the steam in the throat of the nozzle is equal to the speed at which sound would be transmitted through the steam.

If to the simple nozzle (fig. 3) a suitable divergent discharge portion be

added as in fig. 3A, the conditions now existing will be that at the throat of the nozzle a pressure *I*| corresponding to the critical pressure will exist, and beyond this in the divergent portion of the nozzle there will be a further expansion of the steam down to the final discharge pressure P_2. Thus although at the throat of the jet it is impossible to obtain a greater velocity than the speed of sound, by employing a suitably divergent nozzle a final discharge velocity corresponding to the full pressure drop may be obtained.

The simplest mathematical proof of the theory of critical pressure is afforded by considering the operation of the Rankine cycle referred to pressure-volume diagram.